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THE VERTEBRATE FAUNA OF THE BASS STRAIT ISLANDS: 1. THE AMPHIBIA OF FLINDERS AND KING ISLANDS

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Introduction

During the last glacial period of the Pleistocene when the world sea level was more than 240 ft lower than at present (Godwin, Suggate, & Willis 1958; McFarlan 1961; Fairbridge 1962), an extensive land bridge existed between S. Victoria and Tasmania. All the Bass Strait islands were incorporated and a potential biotic corridor was present at a time when the climate of the region was cooler, and probably much wetter, than at present.

An analysis of the present faunas of the largest of the Bass Strait islands, Flinders and King, which are at the same latitude, but were on opposite sides of the land bridge, and comparison with the faunas of S. Victoria and Tasmania, may give an indication of the nature of the Bassian corridor and the possible routes of migration of the terrestrial vertebrate fauna. The only comprehensive faunal report on the Bass Strait area is that of the Field Naturalists Club of Victoria Expedition to King Is. in November 1887 (Spencer 1888). Some more restricted accounts, usually dealing with only a single group, have been published, and this literature will be considered in the reports on the appropriate groups of animals.

The probable post-glacial history of the region may be outlined as follows. Rapid melting of the world continental ice sheets and polar ice began about 16,000 years ago (Fairbridge 1962) and the sea level rose at about 3 ft per century from 14,000 to 6,000 years ago when the present sea levels were attained (Godwin et al. 1958). As the sea level recovered, the sunkland between Cape Otway and King Is. was flooded (about 14,000 years ago). The isthmus between Victoria and Tasmania finally broke to the N. of Flinders Is. about 12,000 years ago. King Is. was separated from Tasmania some 11,000 years ago, and Flinders Is. from Tasmania about 10,000 years ago. The present coastal configuration developed about 6,000 years ago with the stabilizing of the world sea level. These estimates are based on soundings of Bass Strait (Jennings 1959a), and on the dating of post-glacial changes in sea level by Godwin et al. (1958).

Description of the Islands

FLINDERS ISLAND

Physical Features: This island is situated off the NE. corner of Tasmania, about 90 miles SE. of Wilson's Promontory in Victoria. It lies across longitude 148°E. and latitude 40°S., is approximately 40 miles long by 24 miles wide, and has an area of about 513 square miles. The general relief of the island may be described as a central spine of granite running from NE. to SW. and reaching its highest point in the southern Strzelecki Peaks (2,250′), with broad E. and narrow W. coastal plains. A full description is given by Dimmock (1957).

Climate: The climate has been analysed in some detail by the Bureau of Meteorology (no date). It was also discussed by Dimmock (1957) and by Guiler,

Serventy, & Willis (1958). Since no temperature and humidity records were available for the island, data from Currie, King Is., and Eddystone Point, NE. Tasmania were used by these authors to give an indication of climatic conditions on Flinders Is.

The island experiences a mild maritime climate. Much of the rainfall, which ranges from 26-35″ in different parts, is orographic and has a winter maximum (June-August). However, all months receive reasonable amounts over an average of 111 rain days (days on which falls of one point or more were recorded). The Strzelecki Peaks are the wettest, receiving an estimated maximum of 34″. Other high areas receive 30-31″, while most of the coastal plain areas receive 29-31″. Goose Is., 17 miles SW. of Whitemark, receives an annual rainfall of only 21″ and serves to indicate the orographic nature of the rainfall on the larger island (Bureau of Meteorology, no date).

VEGETATION: The dominant floral components of the island, and their distribution, were discussed by Dimmock (1957). In general terms, the vegetation consists of low, scrubby heathland with tea-tree thickets. The foothills and valleys of the Strzelecki Peaks carry scattered tall eucalypts (*Eucalyptus tenuiramus*). A sclerophyll forest develops, where the soil permits it, in the higher parts of the island, e.g. Pat's R. area. While much of the vegetation has been modified through excessive burning and clearing, the original overall pattern is still evident.

KING ISLAND

PHYSICAL FEATURES: King Is. is located roughly half-way between the NW. corner of Tasmania and Cape Otway on the coast of Victoria. The island lies along longitude 144°E. and across latitude 40°S., being approximately 40 miles long, 16 miles wide, and having an area of about 425 square miles. In essence, the island may be described as an inclined plateau of subdued relief, surrounded by a rim of sand dunes. The highest part of the plateau rises to 550′ in the SE., between Mt Stanley (500′) and Naracoopa. Further details of the physical features are given by Stephens & Hosking (1932) and by Jennings (1959b).

CLIMATE: A brief account was given by Stephens & Hosking (1932). Relatively complete meteorological data are available for one station, Currie (Bureau of Meteorology 1956), and rainfall figures for a number of stations (Nicholls & Aves 1961). The climate of King Is. is basically similar to that of Flinders Is., but some possibly significant differences exist. The annual average rainfall is higher, ranging from about 27″ in the N. to 42″ in the SE. More than three-quarters of the island receives an annual rainfall in excess of 34″, an amount received by only a very small area of Flinders Is. The other difference is seen in the number of rain days per year which averages 212 at Currie, as against 111 at Whitemark, Flinders Is. (Bureau of Meteorology 1954).

VEGETATION: Much of the island has been cleared and repeatedly burnt so that the original pattern of vegetation is now greatly modified, more so than on Flinders Is. The wetter parts of the SE. were once covered by a tall sclerophyll forest (*Eucalyptus viminalis*), the stumps of which are still visible today. There are also records of the Celery-top Pine (*Phyllocladus asplenifolius*) growing on the island during the early part of the 19th century (Jennings 1959b). Logs and stumps of this species were found as late as 'a few years ago' near Yarra Ck. Celery-top Pine is at present restricted to Tasmania. Fossil pollen of *P. asplenifolius, Nothofagus cunninghamii* (Southern Beech), and *Drimys lanceolata* (Mountain Pepper) has been collected from a deltaic deposit in the City of Melbourne Bay, near Yarra Ck

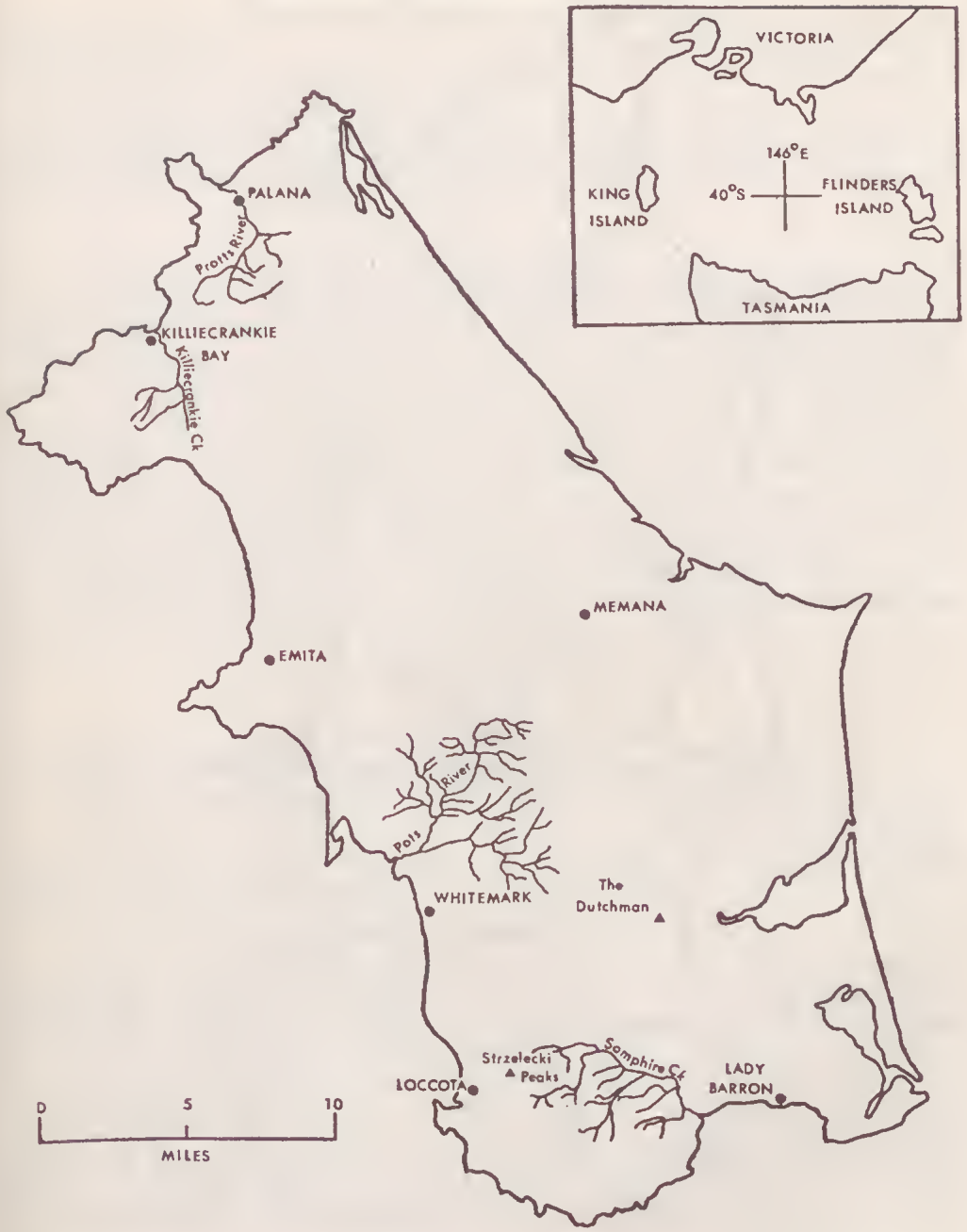

FIG. 1—Locality map of Flinders Is. The inset shows the position of Flinders and King Is. in Bass Strait.

FIG. 2—Locality map of King Is.

(Jennings 1959b). The latter two species exist today in mainland and Tasmanian temperate rainforests, but there is no record of them living on King Is. during historic times. The deeper valleys of the Yarra Ck still carry traces of the temperate rainforest, including treeferns (Jennings 1959b).

A general description of the flora was given by Spencer (1888)—before the drastic modification—and more recently by Stephens & Hosking (1932). The remaining uncleared portions of the island are covered in low scrubby coastal vegetation and tea-tree thickets.

Amphibian Fauna

The islands were visited twice each (Flinders Is. in October 1962 and February 1964, and King Is. in November 1963 and March 1964) during the breeding seasons of all the species present. No cryptic (sibling) species were found and the identity of those forms which belong in species complexes was determined from their breeding biology, particularly mating call structure, as well as morphology.

The island populations do not appear to have diverged to any extent in their morphology when compared with adjacent mainland and Tasmanian samples. The mating call structure of two species, *Crinia signifera* and *Hyla ewingi*, has been examined in detail (Littlejohn 1964, 1965) and some differences are present. The calls of the other species have not yet been subjected to critical comparison, but they seem very similar to the mainland and Tasmanian representatives.

All localities are given with reference to towns or major physical features. These are shown in Fig. 1, 2. For each species, the list of voice records includes only localities additional to those where specimens were collected.

FLINDERS ISLAND

Hylidae

Hyla aurea raniformis (Lesson)

Specimens Examined: 6 miles NW. of Lady Barron, 2 ♀, 6 ♂, 1 juv.

Voice Records: 7 miles SE. of Whitemark; 4 miles NE. of Lady Barron.

Field Observations: In full chorus on the nights of 26-27.X.62 and 29.X.62, and many more were seen than were collected. Frogs were calling while floating in open water at water temperatures of 14·0-15·0°C.

Hyla ewingi Dumeril & Bibron

Specimens Examined: 6 miles NNE. of Whitemark, 1 ♂; The Dutchman, 4 ♀, 5 ♂, 2 hgr.; 2 miles E. of The Dutchman, 9 ♀; 7 miles SE. of Whitemark, 19 ♂; 6 miles NW. of Lady Barron, 4 ♀, 15 ♂, 2 juv.; Loccota, 2 ♀, 9 ♂; Lady Barron, 1 ♂; Big Dog Is. (3 miles S. of Lady Barron), 2 ♀.

Voice Records: 5 miles SE. of Whitemark; 3 miles NW. of Lady Barron.

Field Observations: Choruses were heard during the evenings of 25-29.X.62 and 22-25.II.64. Four mating pairs were collected on 30.X.62. The mating call structure is similar to that of Tasmanian *H. ewingi* (Littlejohn 1965). Males called from the banks of ponds, or in adjacent vegetation up to 18″ above the ground. Calling temperatures (air, wet bulb) were between 9·0 and 10·5°C.

Leptodactylidae

Crinia signifera Girard

Specimens Examined: 4 miles SE. of Killiecrankie Bay, tadpoles; 8 miles NNW. of Whitemark, 3 ♀, 1 ♂; 6 miles NNE. of Whitemark, 2 ♀, 18 ♂; 3 miles

NE. of Whitemark, 3 ♀; The Dutchman, 2 ♀, 4 ♂, 1 juv.; 6 miles NW. of Lady Barron, 22 ♂.

Voice Records: Palana; Whitemark; 5 miles SE. of Whitemark; Loccota; 4 miles NNE. of Lady Barron; 5 miles W. of Lady Barron; Lady Barron.

Field Observations: In chorus on the nights of 25-30.X.62, and also calling during the period 23-25.II.64. Males were calling from the grassy banks of shallow ponds and creeks, and wet bulb air temperatures at the calling sites ranged from 10·25 to 11·5°C.

Limnodynastes dorsalis (Gray)

Specimens Examined: 4 miles SE. of Killiecrankie Bay, tadpoles; 2 miles E. of The Dutchman, 7 hgr.; 7 miles SE. of Whitemark, 1 ♀, 1 ♂; 6 miles NW. of Lady Barron, 9 ♂.

Voice Records: 6 miles N. of Whitemark; Whitemark; 5 miles SE. of Whitemark; 4 miles NE. of Lady Barron.

Field Observations: In chorus on 25-29.X.62 and also calling on 23-26.II.64. Males were calling from the cover of emergent vegetation in ponds and a flooded field at water temperatures of 14·0-15·0°C. The specimens show close morphological similarity to those from E. coastal Victoria and Tasmania, and may be classified as *L. dorsalis insularis* (as defined by Parker 1940).

Limnodynastes tasmaniensis Günther

Specimens Examined: The Dutchman, 2 ♀, 4 hgr.; 2 miles E. of The Dutchman, 7 ♀, 2 hgr.; 6 miles NW. of Lady Barron, 7 ♂; Loccota, 3 ♀, 2 ♂.

Voice Records: Whitemark; 3 miles NE. of Lady Barron; Lady Barron.

Field Observations: In chorus on 25-30.X.62, and also heard on 26.II.64. The call is a single pulse or 'click', characteristic of this species in S. Victoria and Tasmania (Littlejohn & Martin 1965). Males were calling while floating in open water in a shallow pond at water temperatures of 14·0-15·0°C.

Pseudophryne semimarmorata Lucas

Specimens Examined: 8 miles N. of Whitemark, 2 ♀, 1 ♂; 3 miles NE. of Whitemark, 2 ♀; The Dutchman, 6 ♀, 17 ♂; 2 miles E. of The Dutchman, 1 ♂; 5 miles SE. of Whitemark, 2 ♀; 7 miles SE. of Whitemark, 1 ♀, 1 hgr.; Loccota, 1 ♀, 11 ♂; 5 miles W. of Lady Barron, 1 ♂; 4 miles NNE. of Lady Barron, 1 juv.

Voice Records: No additional localities.

Field Observations: In chorus during the period 22-26.II.64. When alive, specimens carried the orange ventral patches typical of *P. semimarmorata*. Mr P. A. Rawlinson noted that males were calling in a shallow depression on land, from the cover of grass tussocks. A metamorphosing individual was collected on 30.X.62.

Literature Records

MacKay (1955) collected specimens which he identified as *Hyla jervisiensis* Dumeril & Bibron and *Crinia tasmaniensis* (Günther). We are familiar with the mating calls and morphology of these species and collected intensively in the area from which his specimens came (8 miles NW. of Lady Barron). No indication of the presence of these species was found. Since both species have close relatives on the island (*Hyla ewingi* and *Crinia signifera*), we suggest that they are the species

collected by MacKay, and that his identifications were incorrect. Moore (1961) listed specimens of *H. ewingi* and *L. dorsalis* from Flinders Is. Littlejohn (1964) recorded the presence of *Hyla ewingi, Crinia signifera, Limnodynastes dorsalis,* and *L. tasmaniensis* on Flinders Is.

KING ISLAND

Hylidae

Hyla aurea raniformis (Lesson)

Specimens Examined: 4 miles E. of Pegarah, 2 ♂; Pearshape, 1 juv.

Voice Records: 5 miles NNW. of Naracoopa; 10 miles E. of Currie; 4 miles SE. of Currie; 3 miles W. of Grassy.

Field Observations: A few individuals were calling on the evenings of 8-11.XI.63, and a chorus was heard by day on 10.XI.63. Males called while floating in open water at water temperatures of 11·0-14·0°C.

Hyla ewingi Dumeril & Bibron

Specimens Examined: 10 miles E. of Currie, 2 juv.; 4 miles E. of Pegarah, 3 ♀, 14 ♂, 1 juv.; 5 miles SSE. of Currie, 8 ♂; Pearshape, 1 ♀.

Voice Records: Naracoopa; 4 miles SE. of Currie; 2 miles NNW. of Pearshape; Surprise Bay.

Field Observations: In light chorus on the evenings of 8-11.XI.63 and 23-24.III.64. Males were calling from grassy banks of ponds at wet bulb air temperatures of 7·0 and 10·0°C.

The morphology and call structure are similar to those of Tasmanian *H. ewingi* (Littlejohn 1965).

Leptodactylidae

Crinia laevis Günther

Specimens Examined: 4 miles E. of Pegarah, 5 ♂; 3 miles N. of Yarra Ck, 1 ♀; 3 miles E. of Lymwood, 7 ♂.

Voice Records: 5 miles NE. of Currie; 3 miles NW. of Naracoopa; 2 miles NE. of Pegarah; Naracoopa; 4 miles SE. of Currie; 2 miles NW. of Yarra Ck; Yarra Ck; 1 mile N. of Lymwood; 4 miles NW. of Grassy.

Field Observations: This species appears to be restricted to the central and SE. parts of the island. Choruses were heard by night and day during 23-25.III.64. Males were calling from tussocks near the edges of ponds and creeks, and wet bulb air temperatures taken at the sites of calling males were 6·0-7·0°C. A single egg mass was collected 3 miles E. of Lymwood on 24.III.64.

The call structure and morphology are similar to those of Tasmanian populations of this species. *Crinia laevis*, while morphologically similar to *C. victoriana* Boulenger, nevertheless, is readily identified on the basis of the mating call (Littlejohn & Martin 1964).

Crinia signifera Girard

Specimens Examined: 4 miles E. of Egg Lagoon, 1 juv.; 7 miles NNW. of Naracoopa, 1 ♀; 4 miles E. of Pegarah, 6 ♂; 2 miles NNW. of Pearshape, 1 ♂; Surprise Bay, 1 ♂.

Voice Records: Currie; 3 miles E. of Currie; 10 miles E. of Currie; Naracoopa; 4 miles SE. of Currie; 3 miles N. of Yarra Ck; 3 miles NW. of Lymwood; Yarra Ck; Grassy; Pearshape.

FIELD OBSERVATIONS: In chorus on the evenings of 8-11.XI.63, and a few were calling on 23-24.III.64. Males were calling from the banks of shallow ponds, near the water's edge. Wet bulb air temperatures of 3·0, 8·0, 10·0 and 12·0°C were taken at these sites when the frogs were calling.

Limnodynastes dorsalis (Gray)

SPECIMENS EXAMINED: Pegarah, 1 ♂; 4 miles SE. of Currie, 1 ♂; 5 miles SE. of Currie, 6 ♂.

VOICE RECORDS: Currie; 10 miles E. of Currie; Pearshape.

FIELD OBSERVATIONS: Calling during 8-11.XI.63, usually from the cover of emergent vegetation in the water at water temperatures of 11·0 and 14·0°C. One male was calling from a shallow depression on the bank where the wet bulb air temperature was 8·0°C.

Morphologically, the specimens resemble those from SW. Victoria and SE. South Australia. These differ in back pattern from the typieal *L. dorsalis insularis* of E. Victoria, Flinders Is., and Tasmania (Fry 1913, Martin unpublished).

Limnodynastes peroni (Dumeril & Bibron)

SPECIMENS EXAMINED: 2 miles NNW. of Pearshape, 1 ♂; Pearshape, 2 ♂, 2 juv.

VOICE RECORD: Surprise Bay.

FIELD OBSERVATIONS: This speeies is apparently restrieted to the extreme SW. corner of the island. Calls were heard during the period 8-11.XI.63. Males were calling from the cover of emergent vegetation, and the water temperature at one site, a shallow pond, was 14·0°C.

Three egg masses of this speeies were seen. These consisted of unpigmented eggs in foamy masses, as is typieal of the species in S. Vietoria (Littlejohn 1963). In NE. Victoria and E. New South Wales, *L. peroni* lays pigmented eggs (Moore 1961, Pl. 36, fig. 3; and our unpublished observations).

LITERATURE RECORDS

Spencer (1888) recorded the presence of *Hyla aurea* (as *Ranoidea aurea*), *Limnodynastes tasmaniensis*, and *Hyla* sp., tree frog, on King Is. Our collcetions confirm the presence of *H. aurea*, and we suggest that the tree frog is *Hyla ewingi*. We found no indication of the presence of *L. tasmaniensis*, and conelude that Spencer may have misidentified a young specimen of *L. peroni*.

Keble (1946) listed *H. aurea* and *L. peroni* as oceurring on King Is. Littlejohn (1965) described the eall strueture of *H. ewingi* from King Is.

Discussion

Eleven species of anurans oceur in W. eoastal and eentral coastal Victoria (Littlejohn 1963; Littlejohn & Martin 1964, 1965) and eight of these are shared with Tasmania and the Bass Strait islands (Table 1). Nine other taxa oeeur in the coastal areas of Gippsland (Table 2), but they are believed to be post-glaeial intrusives from E. New South Wales, and were almost certainly not present when the land bridge was available. Henee, they will not be eonsidered in subsequent diseussion. Two of the species listed in Table 1, *Neobatrachus pictus* Peters and *Pseudophryne bibroni* Günther, may also be post-glacial intrusives, from the drier areas to the N. and W.

TABLE 1

Summary of anuran distribution in the Bass Strait area

Species	Central Coastal & W. Coastal Victoria	Flinders Is.	King Is.	Tasmania
Crinia victoriana	+	—	—	—
Neobatrachus pictus	+	—	—	—
Pseudophryne bibroni	+	—	—	—
P. semimarmorata	+	+	—	+
Limnodynastes tasmaniensis	+	+	—	+
L. peroni	+	—	+	+
Crinia laevis	+	—	+	+
C. signifera	+	+	+	+
Limnodynastes dorsalis	+	+	+	+
Hyla ewingi	+	+	+	+
H. aurea raniformis	+	+	+	+
H. burrowsi	—	—	—	+
Crinia tasmaniensis	—	—	—	+
Totals	11	6	6	10

TABLE 2

Anuran species occurring in Gippsland and S. central Victoria (Moore 1961, Littlejohn, Martin & Rawlinson 1963) *which are believed to be post-glacial intrusives from E. New South Wales.*

Hyla aurea aurea (Lesson)
H. jervisiensis Dumeril & Bibron
H. lesueuri Dumeril & Bibron
H. peroni (Tschudi)
H. phyllochroa Günther
H. verreauxi Dumeril
Crinia haswelli Fletcher
Pseudophryne dendyi Lucas
Uperoleia marmorata Gray

As we presently know it, the anuran fauna of Tasmania consists of ten species (Table 1), two of which, *Hyla burrowsi* Scott and *Crinia tasmaniensis* Günther, are endemic to that island. Moore (1961) lists eleven species of anurans in Tasmania, but he has included the literature records for *P. bibroni*. We have had no difficulty in identifying living specimens of *P. semimarmorata* and intensive collecting in Tasmania has resulted in the procuring of this species only. We conclude, therefore, that *P. bibroni* is absent from Tasmania and that the previous records of *P. bibroni* have referred to specimens of *P. semimarmorata*.

Flinders Is. and King Is. each have six species of anurans, of which four are common to both islands, adjacent Victoria and Tasmania, two to Flinders Is., Victoria, and Tasmania; and two to King Is., Victoria, and Tasmania (Table 1). Thus, all eight species common to Victoria and Tasmania are found on one or other of these two Bass Strait islands.

From our knowledge of the ecology of these species, we may suggest that the difference in faunal composition between the islands reflects that the W. side of the land bridge was much wetter than the E. side at the time the complete corridor was available. This suggestion is supported by the present climatic differences, botanical evidence (Jennings 1959b), and middle latitude climatic changes during glacial times (Keble 1947, Schwarzbach 1963, Flint 1962).

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References

Bureau of Meteorology, Australia, 1951. *Book of Normals No. 1—Rainfall.* Melbourne.

————, 1956. *Climatic averages, Australia.* Melbourne.

————, no date. *Climate of Flinders Island.* Melbourne.

Dimmock, G. M., 1957. Soils of Flinders Island, Tas. *CSIRO, Division of Soils, Soils and Land Use Series* No. 23.

Fairbridge, R. W., 1962. World sea level and climatic changes. *Quaternaria* 6: 111-134.

Flint, R. F., 1963. Pleistocene climates in low latitudes. *Geogr. Rev.* January 1963: 123-129.

Fry, D. B., 1913. On a *Varanus* and a frog from Burnett River, Queensland, and a revision of the variations in *Limnodynastes dorsalis* Gray. *Rec. Aust. Mus.* 10: 17-34.

Godwin, H., Suggate, R. P., and Willis, E. H., 1958. Radiocarbon dating of the eustatic rise in ocean level. *Nature* 181: 1518-1519.

Guiler, E. R., Serventy, D. L., and Willis, J. H., 1958. The Fisher Island Field Station—with an account of its principal fauna and flora. *Pap. and Proc. Roy. Soc. Tas.* 92: 165-183.

Jennings, J. N., 1959a. The submarine topography of Bass Strait. *Proc. Roy. Soc. Vict.* 71: 49-72.

————, 1959b. The coastal geomorphology of King Island, Bass Strait, in relation to changes in the relative level of land and sea. *Rec. Queen Victoria Mus. Launceston* No. 11: 1-39.

Keble, R. A., 1946. The sunklands of Port Phillip Bay and Bass Strait. *Mem. Nat. Mus. Vict.* 14: 69-122.

————, 1947. Notes on Australian Quaternary Climates and Migration. ibid. 15: 20-80.

Littlejohn, M. J., 1963. Frogs of the Melbourne area. *Vict. Nat.* 79: 296-304.

————, 1964. Geographic isolation and mating call differentiation in *Crinia signifera*. *Evolution* 18: 262-266.

————, 1965. Premating isolation in the *Hyla ewingi* complex (Anura: Hylidae). ibid. 19: 234-243.

Littlejohn, M. J., and Martin, A. A., 1964. The *Crinia laevis* complex (Anura: Leptodactylidae) in south-eastern Australia. *Austr. J. Zool.* 12: 70-83.

————, ————, 1965. Mating call structure in three sympatric species of *Limnodynastes* (Anura: Leptodactylidae). *Copeia* (in press).

Littlejohn, M. J., Martin, A. A., and Rawlinson, P. A., 1963. New records of frogs in east Gippsland. *Vict. Nat.* 80: 225-226.

MacKay, R. D., 1955. Notes on a collection of reptiles and amphibians from the Furneaux Islands, Bass Strait. *Austr. Zool.* 12: 160-164.

McFarlan, E., 1961. Radiocarbon dating of late Quaternary deposits, South Louisiana. *Bull. Geol. Soc. Amer.* 72: 129-158.

Moore, J. A., 1961. The frogs of eastern New South Wales. *Bull. Amer. Mus. Nat. Hist.* 121: 149-386.

Nicholls, K. D., and Aves, S. M., 1961. *Average Yearly Rainfall in Tasmania.* Bureau of Meteorology, Melbourne.

Parker, H. W., 1940. The Australasian frogs of the Family Leptodactylidae. *Novit. Zool.* 42: 1-106.

Schwarzbach, M., 1963. *Climates of the Past.* London.

Spencer, B., 1888. Official report of Expedition to King Island by Field Naturalists Club of Victoria, November 1887. *Vict. Nat.* 4: 129-164.

Stephens, C. G., and Hosking, J. S., 1932. A soil survey of King Island. *CSIRO Bull.* 70: 1-55.

Brown, Prior, Anderson Pty. Ltd., 430 Little Bourke Street, Melbourne, C.1.